



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) EP 0 689 967 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.01.1996 Bulletin 1996/01

(51) Int. Cl. 6: B60R 21/00

(21) Application number: 95108771.7

(22) Date of filing: 07.06.1995

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL
PT SE

(30) Priority: 21.06.1994 US 263191

(71) Applicant: TRW VEHICLE SAFETY SYSTEMS INC.
Lyndhurst Ohio 44124 (US)

(72) Inventors:
• Mazur, Joseph F.
Washington, MI 48094 (US)
• Blackburn, Brian K.
Rochester, MI 48307 (US)
• Gentry, Scott B.
Romeo, MI 48065 (US)

(74) Representative: Wagner, Karl H. et al
D-80538 München (DE)

(54) Method and apparatus for sensing a rearward facing child restraining seat

(57) An apparatus (20) for preventing actuation of an air bag restraining device (25) of a vehicle includes a weight sensor (36), a distance sensor (42), and a seat belt payout sensor (66). A controller (22) is operatively connected to the sensors (36, 42, 66) and to the air bag restraining device (25). The controller (22) prevents actuation of the air bag when the sensors (36, 42, 66) sense a rearward facing child seat (46) on the occupant seat (40) by sensing a weight of an object less than a predetermined amount, a distance to an object on the seat (40) less than a predetermined amount, and a seat belt payout greater than a predetermined amount.

EP 0 689 967 A1

Description**Cross-Reference to Related Application**

This is a continuation-in-part of U.S. Patent Application Serial No. 147,682, filed November 3, 1993, to Blackburn, et al., for "Method and Apparatus for Sensing a Rearward Facing Child Seat" and assigned to TRW Vehicle Safety Systems Inc.

Technical Field

The present invention is directed to a vehicle occupant restraint system. The invention is specifically directed to a method and apparatus for sensing a rearward facing child restraining seat and, in response to sensing a rearward facing child restraining seat, preventing deployment of an air bag restraint.

Background of the Invention

Air bag restraint systems for vehicles are well known in the art. It is also known to prevent deployment of an air bag during a vehicle crash when the air bag is associated with a seat location that is unoccupied. Deployment of an air bag associated with an unoccupied seat location (typically the passenger seat location) during a vehicle crash adds unnecessary expense to repair of the vehicle.

To prevent such unnecessary deployment of an air bag at an unoccupied seat location, sensors are provided to detect the presence of an occupant on the vehicle seat. These sensors include pressure sensing switches located in the seat cushion or infrared or ultrasonic sensors located in the vehicle dashboard or instrument panel. If no occupant is detected as being present on the seat, deployment of an associated air bag during a crash condition is prevented through an appropriate control arrangement.

It is also desirable to prevent actuation of an air bag restraint system when a child restraining seat is secured and positioned in a rearward facing orientation on an associated seat location. When a rearward facing child seat is secured to a vehicle seat, deployment of an associated air bag during a vehicle crash condition would not provide the child with additional protection since the child's head and torso would not move relative to the child seat in the direction of vehicle travel.

Summary of the Invention

The present invention provides a method and apparatus for sensing presence and orientation of a child restraining seat and preventing deployment of an associated air bag during a vehicle crash condition if the rearward facing child seat is sensed as being present.

In accordance with the invention, an apparatus is provided for preventing actuation of an actuatable occupant restraining device of a vehicle. The apparatus

includes presence sensing means for sensing the presence of a rearward facing child restraining seat on an occupant seat of the vehicle. The apparatus further includes confirmation sensing means for confirming the presence of the child restraining seat on the occupant seat. Control means is operatively connected to the presence sensing means, the confirmation sensing means, and the actuatable occupant restraining device for preventing actuation of the actuatable occupant restraining device when both (i) the presence sensing means senses a rearward facing child restraining seat on the occupant seat and (ii) the confirmation sensing means confirms the presence of the child restraining seat on the occupant seat.

In accordance with a preferred embodiment of the present invention, an apparatus is provided for preventing actuation of an air bag restraint when a rearward facing child restraining seat is present on an associated occupant seat location. A presence sensing means senses the presence of a rearward facing child restraining seat on the occupant seat. The presence sensing means includes a distance sensor mounted in the instrument panel for providing a signal having a value indicative of the distance between the distance sensor and an object in front of the distance sensor. The distance sensor preferably includes an ultrasonic sensor. The presence sensing means further includes a seat belt payout sensor for providing a signal indicative of the amount of seat belt extracted from a seat belt retractor. An amount of seat belt greater than a threshold amount needs to be extracted to secure a rearward facing child seat to the occupant seat. The apparatus further comprises confirmation sensing means for confirming the presence of a child restraining seat on an occupant seat of a vehicle and for providing a confirmation signal indicative thereof. Preferably, the confirmation sensing means includes a weight sensor for providing the confirmation signal when weight on the occupant seat is less than a threshold amount. Control means is operatively connected to the distance sensor, the belt payout sensor, the weight sensor, and to the actuatable occupant restraining device for preventing actuation of the actuatable occupant restraining device when both the distance sensor and belt payout sensor indicates a rearward facing child restraining seat is on the occupant seat and the weight sensor confirms that the child restraining seat is present on the occupant seat.

Also in accordance with the present invention, a method is provided for preventing actuation of an actuatable occupant restraint device of a vehicle. The method comprises the steps of sensing the presence of a child restraining seat on an associated occupant seat and confirming the presence of the child restraining seat on the occupant seat. Actuation of the actuatable occupant restraining device is prevented when the rearward facing child restraining seat is sensed as being present on the occupant seat and it is confirmed that the child restraining seat is on the occupant seat.

In accordance with a preferred embodiment of the present invention, a method is provided for preventing actuation of an air bag restraint when a rearward facing child restraining seat is present on an associated occupant seat location. The method includes the steps of sensing the distance between the vehicle instrument panel and an object on an occupant seat of a vehicle, sensing seat belt payout, and sensing if weight on the occupant seat is less than a threshold value. The method further comprises the step of preventing actuation of the actuatable occupant restraining device when the sensed distance and sensed belt payout indicate a rearward facing child restraining seat is on the occupant seat and the sensed weight confirms a child restraining seat is on the occupant seat.

Brief Description of the Drawings

The foregoing and other features of the present invention will become apparent to those skilled in the art to which the present invention relates upon consideration of the following description of the invention with reference to the accompanying drawings, wherein:

Fig. 1 is a schematic of an apparatus for controlling an air bag restraint in accordance with the present invention;

Fig. 2 is a schematic block diagram showing a portion of the circuitry of Fig. 1;

Figs. 3-5 are flow charts depicting the control process followed by the controller of Fig. 1; and

Fig. 6 is a schematic block diagram showing another embodiment of a portion of the circuitry of Fig. 1.

Description of Preferred Embodiments

Referring to Figs. 1 and 2, an apparatus 20, in accordance with the present invention, includes a controller 22 operatively connected to an air bag actuation circuit 24. Actuation circuit 24 is operatively coupled to an air bag assembly 25. The air bag actuation circuit 24 includes a transistor 26 that is electrically connected in series between a squib 28 and a source of electrical energy. Controller 22 is controllably connected to the base of transistor 26. When controller 22 actuates transistor 26 so as to turn the transistor "ON", a sufficient amount of electric current for a sufficient time duration passes through squib 28 to ignite the squib.

Squib 28 is operatively coupled to a source of inflation fluid 30, such as an ignitable gas generating material and/or a container of pressurized gas. The inflator 30 is operatively coupled to an air bag 32. Upon ignition of the squib 28, inflation fluid from the inflator 30 inflates air bag 32 to its operative restraining position.

The apparatus 20 further includes a crash sensor 34 operatively connected to controller 22. A weight sensor 36 is operatively mounted in a seat cushion 38 of an occupant seat 40 and is electrically connected to controller 22. The weight sensor 36 provides a signal to the

controller 22 so that the controller can determine whether an object on the occupant seat 40 weighs more than a predetermined value. Weight sensor 36 may be any one of several known in the art. For example, a weight sensor of the type described in U.S. Patent No. 5,232,243 to Blackburn et al. may be used. Alternatively, a switch which opens or closes in response to applied weight greater than the predetermined value may also be used.

5 A typical child restraining seat weighs approximately 10-12 pounds. A small child that would be placed in such a restraining seat in a rearward facing direction would weigh under 20 pounds. In the preferred embodiment, the predetermined threshold weight value is 40 lbs. to

10 account for the presence of a child under 20 lbs. plus the weight of a child restraint seat weighing 10-12 lbs. plus a margin of safety. If an object on the seat cushion 38 weighs more than 40 lbs., it is assumed that the object can not be a rearward facing child seat. If the weight sensor 36 is a switch, it is arranged to provide one signal if an object weighing more than 40 lbs. is on the seat cushion 38. The weight sensor 36 provides a second signal when no object weighing more than 40 lbs. is on the seat cushion 38.

15 20 25 A distance sensor 42 is mounted in instrument panel/dashboard 44 of the vehicle and is electrically connected to controller 22. The distance sensor 42 provides a signal indicative of the distance between the distance sensor 42 and an object located on the occupant seat

30 35 40 45 50 55 40 in operative line with the distance sensor 42. Distance sensor 42 may be any one of several types known in the art. For example, in accordance with a preferred embodiment, an ultrasonic sensor is used. Other sensors that could be used include active or passive infrared sensors.

55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305 1310 1315 1320 1325 1330 1335 1340 1345 1350 1355 1360 1365 1370 1375 1380 1385 1390 1395 1400 1405 1410 1415 1420 1425 1430 1435 1440 1445 1450 1455 1460 1465 1470 1475 1480 1485 1490 1495 1500 1505 1510 1515 1520 1525 1530 1535 1540 1545 1550 1555 1560 1565 1570 1575 1580 1585 1590 1595 1600 1605 1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750 1755 1760 1765 1770 1775 1780 1785 1790 1795 1800 1805 1810 1815 1820 1825 1830 1835 1840 1845 1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095 2100 2105 2110 2115 2120 2125 2130 2135 2140 2145 2150 2155 2160 2165 2170 2175 2180 2185 2190 2195 2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345 2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490 2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640 2645 2650 2655 2660 2665 2670 2675 2680 2685 2690 2695 2700 2705 2710 2715 2720 2725 2730 2735 2740 2745 2750 2755 2760 2765 2770 2775 2780 2785 2790 2795 2800 2805 2810 2815 2820 2825 2830 2835 2840 2845 2850 2855 2860 2865 2870 2875 2880 2885 2890 2895 2900 2905 2910 2915 2920 2925 2930 2935 2940 2945 2950 2955 2960 2965 2970 2975 2980 2985 2990 2995 3000 3005 3010 3015 3020 3025 3030 3035 3040 3045 3050 3055 3060 3065 3070 3075 3080 3085 3090 3095 3100 3105 3110 3115 3120 3125 3130 3135 3140 3145 3150 3155 3160 3165 3170 3175 3180 3185 3190 3195 3200 3205 3210 3215 3220 3225 3230 3235 3240 3245 3250 3255 3260 3265 3270 3275 3280 3285 3290 3295 3300 3305 3310 3315 3320 3325 3330 3335 3340 3345 3350 3355 3360 3365 3370 3375 3380 3385 3390 3395 3400 3405 3410 3415 3420 3425 3430 3435 3440 3445 3450 3455 3460 3465 3470 3475 3480 3485 3490 3495 3500 3505 3510 3515 3520 3525 3530 3535 3540 3545 3550 3555 3560 3565 3570 3575 3580 3585 3590 3595 3600 3605 3610 3615 3620 3625 3630 3635 3640 3645 3650 3655 3660 3665 3670 3675 3680 3685 3690 3695 3700 3705 3710 3715 3720 3725 3730 3735 3740 3745 3750 3755 3760 3765 3770 3775 3780 3785 3790 3795 3800 3805 3810 3815 3820 3825 3830 3835 3840 3845 3850 3855 3860 3865 3870 3875 3880 3885 3890 3895 3900 3905 3910 3915 3920 3925 3930 3935 3940 3945 3950 3955 3960 3965 3970 3975 3980 3985 3990 3995 4000 4005 4010 4015 4020 4025 4030 4035 4040 4045 4050 4055 4060 4065 4070 4075 4080 4085 4090 4095 4100 4105 4110 4115 4120 4125 4130 4135 4140 4145 4150 4155 4160 4165 4170 4175 4180 4185 4190 4195 4200 4205 4210 4215 4220 4225 4230 4235 4240 4245 4250 4255 4260 4265 4270 4275 4280 4285 4290 4295 4300 4305 4310 4315 4320 4325 4330 4335 4340 4345 4350 4355 4360 4365 4370 4375 4380 4385 4390 4395 4400 4405 4410 4415 4420 4425 4430 4435 4440 4445 4450 4455 4460 4465 4470 4475 4480 4485 4490 4495 4500 4505 4510 4515 4520 4525 4530 4535 4540 4545 4550 4555 4560 4565 4570 4575 4580 4585 4590 4595 4600 4605 4610 4615 4620 4625 4630 4635 4640 4645 4650 4655 4660 4665 4670 4675 4680 4685 4690 4695 4700 4705 4710 4715 4720 4725 4730 4735 4740 4745 4750 4755 4760 4765 4770 4775 4780 4785 4790 4795 4800 4805 4810 4815 4820 4825 4830 4835 4840 4845 4850 4855 4860 4865 4870 4875 4880 4885 4890 4895 4900 4905 4910 4915 4920 4925 4930 4935 4940 4945 4950 4955 4960 4965 4970 4975 4980 4985 4990 4995 5000 5005 5010 5015 5020 5025 5030 5035 5040 5045 5050 5055 5060 5065 5070 5075 5080 5085 5090 5095 5100 5105 5110 5115 5120 5125 5130 5135 5140 5145 5150 5155 5160 5165 5170 5175 5180 5185 5190 5195 5200 5205 5210 5215 5220 5225 5230 5235 5240 5245 5250 5255 5260 5265 5270 5275 5280 5285 5290 5295 5300 5305 5310 5315 5320 5325 5330 5335 5340 5345 5350 5355 5360 5365 5370 5375 5380 5385 5390 5395 5400 5405 5410 5415 5420 5425 5430 5435 5440 5445 5450 5455 5460 5465 5470 5475 5480 5485 5490 5495 5500 5505 5510 5515 5520 5525 5530 5535 5540 5545 5550 5555 5560 5565 5570 5575 5580 5585 5590 5595 5600 5605 5610 5615 5620 5625 5630 5635 5640 5645 5650 5655 5660 5665 5670 5675 5680 5685 5690 5695 5700 5705 5710 5715 5720 5725 5730 5735 5740 5745 5750 5755 5760 5765 5770 5775 5780 5785 5790 5795 5800 5805 5810 5815 5820 5825 5830 5835 5840 5845 5850 5855 5860 5865 5870 5875 5880 5885 5890 5895 5900 5905 5910 5915 5920 5925 5930 5935 5940 5945 5950 5955 5960 5965 5970 5975 5980 5985 5990 5995 6000 6005 6010 6015 6020 6025 6030 6035 6040 6045 6050 6055 6060 6065 6070 6075 6080 6085 6090 6095 6100 6105 6110 6115 6120 6125 6130 6135 6140 6145 6150 6155 6160 6165 6170 6175 6180 6185 6190 6195 6200 6205 6210 6215 6220 6225 6230 6235 6240 6245 6250 6255 6260 6265 6270 6275 6280 6285 6290 6295 6300 6305 6310 6315 6320 6325 6330 6335 6340 6345 6350 6355 6360 6365 6370 6375 6380 6385 6390 6395 6400 6405 6410 6415 6420 6425 6430 6435 6440 6445 6450 6455 6460 6465 6470 6475 6480 6485 6490 6495 6500 6505 6510 6515 6520 6525 6530 6535 6540 6545 6550 6555 6560 6565 6570 6575 6580 6585 6590 6595 6600 6605 6610 6615 6620 6625 6630 6635 6640 6645 6650 6655 6660 6665 6670 6675 6680 6685 6690 6695 6700 6705 6710 6715 6720 6725 6730 6735 6740 6745 6750 6755 6760 6765 6770 6775 6780 6785 6790 6795 6800 6805 6810 6815 6820 6825 6830 6835 6840 6845 6850 6855 6860 6865 6870 6875 6880 6885 6890 6895 6900 6905 6910 6915 6920 6925 6930 6935 6940 6945 6950 6955 6960 6965 6970 6975 6980 6985 6990 6995 7000 7005 7010 7015 7020 7025 7030 7035 7040 7045 7050 7055 7060 7065 7070 7075 7080 7085 7090 7095 7100 7105 7110 7115 7120 7125 7130 7135 7140 7145 7150 7155 7160 7165 7170 7175 7180 7185 7190 7195 7200 7205 7210 7215 7220 7225 7230 7235 7240 7245 7250 7255 7260 7265 7270 7275 7280 7285 7290 7295 7300 7305 7310 7315 7320 7325 7330 7335 7340 7345 7350 7355 7360 7365 7370 7375 7380 7385 7390 7395 7400 7405 7410 7415 7420 7425 7430 7435 7440 7445 7450 7455 7460 7465 7470 7475 7480 7485 7490 7495 7500 7505 7510 7515 7520 7525 7530 7535 7540 7545 7550 7555 7560 7565 7570 7575 7580 7585 7590 7595 7600 7605 7610 7615 7620 7625 7630 7635 7640 7645 7650 7655 7660 7665 7670 7675 7680 7685 7690 7695 7700 7705 7710 7715 7720 7725 7730 7735 7740 7745 7750 7755 7760 7765 7770 7775 7780 7785 7790 7795 7800 7805 7810 7815 7820 7825 7830 7835 7840 7845 7850 7855 7860 7865 7870 7875 7880 7885 7890 7895 7900 7905 7910 7915 7920 7925 7930 7935 7940 7945 7950 7955 7960 7965 7970 7975 7980 7985 7990 7995 8000 8005 8010 8015 8020 8025 8030 8035 8040 8045 8050 8055 8060 8065 8070 8075 8080 8085 8090 8095 8100 8105 8110 8115 8120 8125 8130 8135 8140 8145 8150 8155 8160 8165 8170 8175 8180 8185 8190 8195 8200 8205 8210 8215 8220 8225 8230 8235 8240 8245 8250 8255 8260 8265 8270 8275 8280 8285 8290 8295 8300 8305 8310 8315 8320 8325 8330 8335 8340 8345 8350 8355 8360 8365 8370 8375 8380 8385 8390 8395 8400 8405 8410 8415 8420 8425 8430 8435 8440 8445 8450 8455 8460 8465 8470 8475 8480 8485 8490 8495 8500 8505 8510 8515 8520 8525 8530 8535 8540 8545 8550 8555 8560 8565 8570 8575 8580 8585 8590 8595 8600 8605 8610 8615 8620 8625 8630 8635 8640 8645 8650 8655 8660 8665 8670 8675 8680 8685 8690 8695 8700 8705 8710 8715 8720 8725 8730 8735 8740 8745 8750 8755 8760 8765 8770 8775 8780 8785 8790 8795 8800 8805 8810 8815 8820 8825 8830 8835 8840 8845 8850 8855 8860 8865 8870 8875 8880 8885 8890 8895 8900 8905 8910 8915 8920 8925 8930 8935 8940 8945 8950 8955 8960 8965 8970 8975 8980 8985 8990 8995 9000 9005 9010 9015 9020 9025 9030 9035 9040 9045 9050 9055 9060 9065 9070 9075 9080 9085 9090 9095 9100 9105 9110 9115 9120 9125 9130 9135 9140 9145 9150 9155 9160 9165 9170 9175 9180 9185 9190 9195 9200 9205 9210 9215 9220 9225 9230 9235 9240 9245 9250 9255 9260 9265 9270 9275 9280 9285 9290 9295 9300 9305 9310 9315 9320 9325 9330 9335 9340 9345 9350 9355 9360 9365 9370 9375 9380 9385 9390 9395 9400 9405 9410 9415 9420 9425 9430 9435 9440 9445 9450 9455 9460 9465 9470 9475 9480 9485 9490 9495 9500 9505 9510 9515 9520 9525 9530 9535 9540 9545 9550 9555 9560 9565 9570 9575 9580 9585 9590 9595 9600 9605 9610 9615 9620 9625 9630 9635 9640 9645 9650 9655 9660 9665 9670 9675 9680 9685 9690 9695 9700 9705 9710 9715 9720 9725 9730 9735 9740 9745 9750 9755 9760 9765 9770 9775 9780 9785 9790 9795 9800 9805 9810 9815 9820 9825 9830 9835 9840 9845 9850 9855 9860 9865 9870 9875 9880 9885 9890 9895 9900 9905 9910

Seat belt retractor 58 is attached to vehicle floor 50. Seat belt payout sensor 66 measures the length of seat belt 48 extracted from or paid out from seat belt retractor 58 and provides an electrical signal indicative of the length of seat belt 48 paid out. When a child restraining seat is secured in a rearward facing direction, a belt payout equal to or greater than a predetermined amount occurs. Therefore, if the belt payout indication is greater than the predetermined amount, it is assumed that a rearward facing child seat is present. Seat belt payout sensor 66 may be any one of several types including a potentiometer that provides an electrical signal having a value functionally related to the length of seat belt 48 extracted. A threshold on/off switch may be used which switches state when the predetermined length of seat belt 48 is extracted.

Empirical testing has indicated that approximately 36 inches of seat belt is needed to secure a rearward facing child seat on the occupant seat 40. It takes approximately 30 inches of belt to secure a forward facing child seat. Therefore, the belt payout threshold value is set internal to controller 22 at 35 inches.

Controller 22 includes both an enable function 68 and an evaluation function 70. When both functions provide a digital HIGH signal, controller 22 actuates circuit 24 to energize the squib 28.

Referring to Figs. 1 & 2, the evaluation function 70 and the enable function 68 of controller 22 will be better appreciated. A vehicle crash sensor 34 is operatively mounted to the vehicle and electrically connected to controller 22. Crash sensor 34 may be any one of several known crash sensors, including an inertia switch or an accelerometer. In a preferred embodiment, the crash sensor is an accelerometer.

Crash sensor 34 provides an electrical signal to controller 22 indicative of the vehicle's crash acceleration. Those skilled in the art will appreciate that controller 22 may use any one of several known algorithms to analyze the accelerometer signal and, in response to the signal, control the air bag actuation circuit 24. For example, the acceleration signal may be integrated to determine a crash velocity value. If the crash velocity exceeds a predetermined crash velocity threshold value, evaluation function 70 provides a digital HIGH signal to one input of an ANDING function 72 of controller 22.

Sensors 36, 42, 66 provide electrical signals to controller 22. The electrical signals from sensors 36, 42, 66 are used by controller 22 to determine the presence of a rearward facing child seat 46 on occupant seat 40. If controller 22 determines from the sensor signals that a rearward facing child seat is present, the enable function 68 outputs a LOW signal to a second input of ANDING function 72. This LOW output from the enable function 68 disables air bag actuation circuit 24. The enable function 68 normally provides a digital HIGH signal referred to herein as the enable function's default condition.

When controller 22 receives appropriate signals from both (i) distance sensor 42 indicating the presence of a rearward facing child restraining seat on occupant

5 seat 40, and (ii) weight sensor 36 confirming the presence of a child restraining seat on occupant seat 40, the controller decides that a rearward facing child seat is present. The controller makes this decision by comparing the measured distance and weight against associated threshold values. When the distance sensor 42 indicates that a rearward facing child restraining seat is present and the weight sensor 36 confirms the presence of a child restraining seat, the enable function 68 provides a digital LOW signal. The LOW signal from enable function 68 prevents air bag actuation circuit 24 from energizing squib 28 since the output of the ANDING function 72 will be a LOW. When the air bag system is disabled, the controller 22 provides an electric signal to an indicator 74 on the instrument panel/dashboard 44 to alert the vehicle occupants that the air bag assembly 25 is disabled.

20 In accordance with another embodiment of the present invention, controller 22 monitors the signal from weight sensor 36 as described above. As mentioned, seat belt payout sensor 66 provides an electrical signal to controller 22 indicating the length of seat belt 48 extracted from seat belt retractor assembly 58. Controller 22 determines whether the length of seat belt 48 extended exceeds the predetermined length threshold value which would indicate the presence of a rearward facing child restraining seat 46. When controller 22 receives signals from both (i) payout sensor 66 indicating a presence of a rearward facing child restraining seat 46 and, (ii) weight sensor 36 confirming the presence of a child restraining seat 46 on occupant seat 40, the controller decides that a rearward facing child seat is present. The controller accomplishes this by comparing measured belt payout and weight against associated limits. When the payout sensor 66 indicates that a rearward facing child restraining seat is present and the weight sensor 36 confirms the presence of a child restraining seat, the enable function 68 provides a digital LOW signal. The LOW signal from enable function 68 prevents air bag actuation circuit 24 from energizing squib 28 since the output of ANDING function 72 will be LOW. When the air bag is disabled, the controller 22 provides an electric signal to an indicator 74 mounted in the instrument panel/dashboard 44 to alert the vehicle occupants that the air bag assembly 25 is disable.

25 In accordance with yet another embodiment of the present invention, controller 22 monitors signals from weight sensor 36, distance sensor 42, and seat belt payout sensor 66.

30 When controller 22 receives appropriate signals from (i) payout sensor 66 indicating a presence of a rearward facing child seat, (ii) distance sensor 42 indicating the presence of rearward facing child restraining seat 46, and (iii) weight sensor 36 confirming the presence of a child restraining seat 46 on occupant seat 40, the controller decides that a child restraining seat is present. The controller accomplishes this by comparing measured belt payout, distance, and weight against associated limits. When the payout sensor 66 indicates that a rearward

facing child seat is present and the distance sensor 42 indicates that a rearward facing child restraining seat is present and the weight sensor 36 confirms the presence of a child restraining seat, the enable function 68 provides a digital LOW signal to ANDING function 72. The LOW signal from enable function 68 prevents energization of squib 28. When the air bag is disabled, the controller 22 provides an electric signal to indicator 74 to alert the vehicle occupants that the air bag assembly 25 is disabled.

Referring to Fig. 3, the control process of the present invention will be better appreciated. In step 100, the control process is initialized by the controller 22 setting the enable function 68 to a default state providing a digital HIGH signal so as to enable the air bag system and deactuating indicator 74. In step 102, weight sensor 36 measures the weight of an object on occupant seat 40 and provides an electric signal indicative of weight to controller 22. The process proceeds to step 104 where controller 22 determines whether the electrical signal provided by weight sensor 36 indicates a weight less than 40 lbs. If the determination in step 104 is affirmative, i.e., less than 40 lbs., the process proceeds to step 106.

In step 106, the distance sensor 42 measures the distance between an object on occupant seat 40 and distance sensor 42 and provides an electrical signal to controller 22 indicative of the measured distance. In step 108, controller 22 determines whether the electrical signal provided by distance sensor 42 indicates an object is at a distance of less than nine inches from sensor 42. If the determination in step 108 is affirmative, the process proceeds to step 112 where the controller 22 disables the air bag actuation circuit 24. The process then proceeds to step 114 where indicator 74 is actuated to alert the vehicle occupants that the passenger air bag restraint system is disabled. From step 114, the process returns to step 102. From a negative determination in either step 104 or in step 108, the process proceeds to step 110 where the indicator 60 is deactivated (or remains deactivated) and the air bag system is enabled (or remains enabled). From step 110, the process returns to step 102. It will be appreciated by those skilled in the art that the control process repeats and evaluates the sensor signals continuously. Also, the order of steps 104 and 108 may be reversed.

Fig. 4 illustrates another control process in accordance with the present invention. As in the control process of Fig. 3, in step 100, the enable function 68 is set to its default state providing a digital HIGH signal to enable the air bag system and the indicator 74 is deactivated. In step 102, weight sensor 36 measures the weight of an object on occupant seat 40 and provides an electric signal indicative of weight to controller 22. The process proceeds to step 104 where controller 22 determines whether the electrical signal provided by weight sensor 36 indicates a weight less than 40 lbs. If the determination in step 104 is affirmative, i.e., less than 40 lbs., the process proceeds to step 116.

In step 116, seat belt payout sensor 66 provides controller 22 with an electrical signal indicating the length of seat belt 48 extended from seat belt retractor assembly 58. The process then proceeds to step 118 where controller 22 determines whether the length of seat belt 48 extracted is greater than 35 inches. If the determination in step 118 is affirmative, the process proceeds to step 112 where the controller 22 disables the air bag actuation circuit 24. The process proceeds from step 112 to step 114 where indicator 74 is actuated to alert the vehicle occupants that the passenger air bag restraint system is disabled. The process returns from step 114 to step 102. From a negative determination in either step 104 or step 118, the process proceeds to step 110 where the indicator 74 is deactivated (or remains deactivated) and the air bag system is enabled (or remains enabled). From step 110, the process returns to step 102. It will be appreciated by those skilled in the art that the control process repeats and evaluates the sensor signals continuously. Also, the order of steps 104 and 118 may be reversed.

Referring to Fig. 5, yet another control process in accordance with the present invention is shown. As above, in step 100, the enable function 68 is set to its default state providing a digital HIGH signal to enable the air bag system and indicator 74 is deactivated. In step 102, weight sensor 36 measures the weight of an object on occupant seat 40 and provides an electrical signal indicative of weight to controller 22. The process proceeds to step 104 where controller 22 determines whether the electrical signal provided by weight sensor 36 indicates a weight less than 40 lbs. If the determination in step 104 is affirmative, i.e., less than 40 lbs., the process proceeds to step 106.

In step 106, the distance sensor 42 measures the distance between an object on occupant seat 40 and distance sensor 42. An electrical signal is provided to controller 22 indicative of the measured distance. The process thus proceeds to step 108. In step 108, controller 22 determines whether the electrical signal provided by distance sensor 42 indicates a distance less than nine inches. If the determination is affirmative, the process proceeds to step 116.

In step 116, seat belt payout sensor 66 provides controller 22 with an electrical signal indicating the length of seat belt 48 extended from seat belt retractor assembly 58. The process then proceeds to step 118 where controller 22 determines whether the length of seat belt 48 extended is greater than 35 inches. If the determination is affirmative, the process proceeds to step 112 where the controller 22 disables the air bag actuation circuit 24. The process then proceeds from step 112 to step 114 where indicator 74 is actuated to alert the vehicle occupants that the passenger air bag restraint system is disabled. The process returns from step 114 to step 102. From a negative determination in any of steps 104, 108, or 118, the process proceeds to step 110 where indicator 74 is deactivated (or remains deactivated) and the air bag system is enabled (or remains enabled). The process returns from step 110 to step 102. It will be appreciated

by those skilled in the art that the control process repeats and evaluates the sensor signals continuously. Also, the order of steps 104, 108 and 118 may be different from that shown and described.

Referring to Fig. 6, an alternate embodiment of the present invention is shown. The squib 28 is connected in series with transistor 26, an inertia switch 78, and diode 80 across a source of electrical energy. This forms a series connected firing circuit. A storage capacitor 82 is connected to the cathode side of diode 80, as is known in the art, to provide a back-up energy source. During a crash event of sufficient intensity, inertia switch 78 will close. The controller 22 is operatively connected to weight sensor 36, distance sensor 42 and seat belt payout sensor 66 as described above. Sensors 36, 42 and 66 provide electrical signals to controller 22. The controller 22 determines whether there is a rearward facing child restraining seat 46 on occupant seat 40 as described above. If the determination is affirmative, controller 22 prevents actuation of the transistor 26 thereby preventing completion of the firing circuit even if the inertia switch 78 closes. If no rearward facing child seat is sensed, the controller 22 provides a control signal to turn transistor 26 ON. When transistor 26 is ON and inertia switch 78 closes, the squib 28 is ignited resulting in deployment of the air bag.

It should be appreciated by those skilled in the art that the distance sensor 42 and/or the belt payout sensor 66 function affirmatively to sense the presence of a rearward facing child restraining set. The weight sensor functions as a confirmation sensor to confirm the presence of a child restraining seat on the occupant seat. Assume an occupant (an adult) is on the occupant seat holding a newspaper within 9 inches of the distance sensor. Since the adult would weigh more than 40 lbs. the weight sensor would not provide the confirmation needed to indicate a rearward facing child seat. Assume that a very large adult is on the occupant seat and extends the seat belt 35 inches. The large adult would weigh more than 40 lbs. Therefore, the weight sensor would not provide the confirmation needed to disable the air bag system.

From the above description of the invention, those skilled in the art will perceive improvements, changes and modifications. For example, the threshold weight value of 40 lbs. and the threshold sensed distance value of 9 in. could vary depending upon the requirements of the vehicle manufacturer and the configuration of the interior of the particular vehicle in which the invention is used. Such improvements, changes and modifications are intended to be covered by the appended claims.

Claims

1. An apparatus for preventing actuation of an actuatable occupant restraining device of a vehicle, said apparatus comprising:

presence sensing means for sensing the presence of a rearward facing child restraining seat on an occupant seat of the vehicle and for providing

a presence signal indicative thereof;

confirmation sensing means for confirming the presence of said child restraining seat on said occupant seat and for providing a confirmation signal indicative thereof; and

control means operatively connected to said presence sensing means, said confirmation sensing means, and to said actuatable occupant restraining device for preventing actuation of said actuatable occupant restraining device when both said presence signal indicates said rearward facing child restraining seat is on said occupant seat and said signal from said confirmation sensing means confirms said child restraining seat is on said occupant seat.

5. The apparatus of claim 1 wherein said confirmation sensing means includes weight sensing means for sensing weight on said occupant seat and for providing said confirmation signal indicative of said child restraining seat being on said occupant seat when the weight on said occupant seat is less than a weight threshold value.
10. The apparatus of claim 2 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold value.
15. The apparatus of claim 3 wherein said distance sensing means is an ultrasonic sensor.
20. The apparatus of claim 4 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
25. The apparatus of claim 5 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
30. The apparatus of claim 6 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
35. The apparatus of claim 7 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
40. The apparatus of claim 8 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
45. The apparatus of claim 9 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
50. The apparatus of claim 10 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
55. The apparatus of claim 11 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
60. The apparatus of claim 12 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
65. The apparatus of claim 13 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
70. The apparatus of claim 14 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
75. The apparatus of claim 15 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
80. The apparatus of claim 16 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
85. The apparatus of claim 17 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.
90. The apparatus of claim 18 wherein said presence sensing means includes seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value.
95. The apparatus of claim 19 wherein said presence sensing means includes distance sensing means mounted to an instrument panel of the vehicle for providing a signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence signal being provided when said sensed distance is less than or equal to a distance threshold.

seat to said occupant seat for providing a signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when said extended length is greater than or equal to a length threshold value. 5

8. The apparatus of claim 1 wherein said presence sensing means includes distance sensing means mounted to an instrument panel for providing a distance signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence sensing means further including seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt used to secure said child restraining seat to said occupant seat for providing a seat belt length signal indicative of a length of said seat belt extended from said retractor, said presence signal being provided when both said distance signal indicates a distance less than first threshold value and said seat belt payout presence signal indicates an extended belt length greater than a second threshold value. 10

9. The apparatus of claim 8 wherein said confirmation sensing means includes weight sensing means for sensing weight upon said occupant seat and for providing said confirmation signal indicative of said child restraining seat being on said occupant seat when the sensed weight on said occupant seat is less than a weight threshold value. 15

10. An apparatus for preventing actuation of an actuatable occupant restraining device of a vehicle, said apparatus comprising:
 presence sensing means for sensing the presence of a rearward facing child restraining seat on an occupant seat of the vehicle, said presence sensing means including distance sensing means mounted to an instrument panel for providing a distance signal indicative of the distance between said distance sensing means and an object on said occupant seat, said presence sensing means further including a seat belt payout sensing means operatively connected to a seat belt retractor of a seat belt for providing a seat belt length signal indicative of a length of said seat belt extended from said retractor; 20
 confirmation sensing means for confirming the presence of said child restraining seat on said occupant seat and for providing a signal indicative thereof; and 25
 control means operatively connected to said presence sensing means, said confirmation sensing means, said crash sensing means, and to said air bag restraint for actuating the air bag restraint in response to said crash sensing means unless both (i) said presence signal from said presence sensing means indicates said rearward facing child restraining seat is on said occupant seat and (ii) said confirmation signal from said confirmation sensing means confirms the presence of said child restraining seat on said occupant seat. 30

11. The apparatus of claim 10 wherein said confirmation sensing means includes weight sensing means for sensing weight on said occupant seat and for providing said confirmation signal indicative of said child restraining seat being on said occupant seat when the weight on said occupant seat is less than a weight threshold value. 35

12. An apparatus for preventing actuation of an air bag restraint when a rearward facing child restraining seat is present on an associated occupant seat location, said apparatus comprising:
 crash sensing means for sensing a vehicle crash condition and providing a signal indicative thereof;
 presence sensing means for determining whether said rearward facing child restraining seat is on said occupant seat and for providing a presence signal indicative thereof; 40
 confirmation sensing means for confirming the presence of said child restraining seat on said occupant seat and for providing a confirmation signal indicative thereof; and
 control means operatively connected to said presence sensing means, said confirmation sensing means, said crash sensing means, and to said air bag restraint for actuating the air bag restraint in response to said crash sensing means unless both (i) said presence signal from said presence sensing means indicates said rearward facing child restraining seat is on said occupant seat and (ii) said confirmation signal from said confirmation sensing means confirms the presence of said child restraining seat on said occupant seat. 45

13. A method for preventing the actuation of an actuatable occupant restraint device of a vehicle, said method comprising the steps of:
 sensing the presence of a rearward facing child restraining seat on an occupant seat of the vehicle and providing a presence signal indicative thereof; 50
 confirming the presence of said child restraining seat on said occupant seat and providing a confirmation signal indicative thereof; and
 preventing actuation of said actuatable occupant restraining device when said rearward facing child restraining seat is sensed as being present on said occupant seat and the presence of said child restraining seat on said occupant seat is confirmed. 55

14. The method of claim 13 wherein said step of confirming presence includes the step of sensing the weight upon said occupant seat and providing said confirmation signal when the sensed weight is less than or equal to a weight threshold value. 5

15. The method of claim 14 wherein said step of sensing presence includes the step of sensing a distance between an instrument panel and an object on the occupant seat and providing said presence signal when the distance between said object on said occupant seat and said instrument panel is less than or equal to a distance threshold value. 10

16. The method of claim 14 wherein said step of sensing presence includes the step of sensing the length of seat belt extended from a retractor and for providing said presence signal when the sensed extended length of said seat belt extracted from the retractor is greater than a length threshold value. 15 20

17. The method of claim 13 wherein said step of sensing presence includes the step of sensing distance between an instrument panel and an object on the occupant seat, and providing said presence signal when the sensed distance is less than or equal to a distance threshold value. 25

18. The method of claim 13 wherein said step of sensing presence includes the step of sensing seat belt payout and providing said presence signal when the sensed amount of seat belt extracted from a retractor is greater than or equal to a length threshold value. 30 35

19. The method of claim 13 wherein said step of sensing presence includes the step of sensing distance between an instrument panel and an object on the occupant seat and sensing seat belt payout, said presence signal being provided when said belt payout is greater than or equal to a length threshold value, and said sensed distance is less than a distance threshold value. 40

20. The method of claim 19 wherein said step of confirming presence includes sensing weight on said occupant seat and providing said confirmation signal when the sensed weight is less than or equal to a weight threshold value. 45

50

55

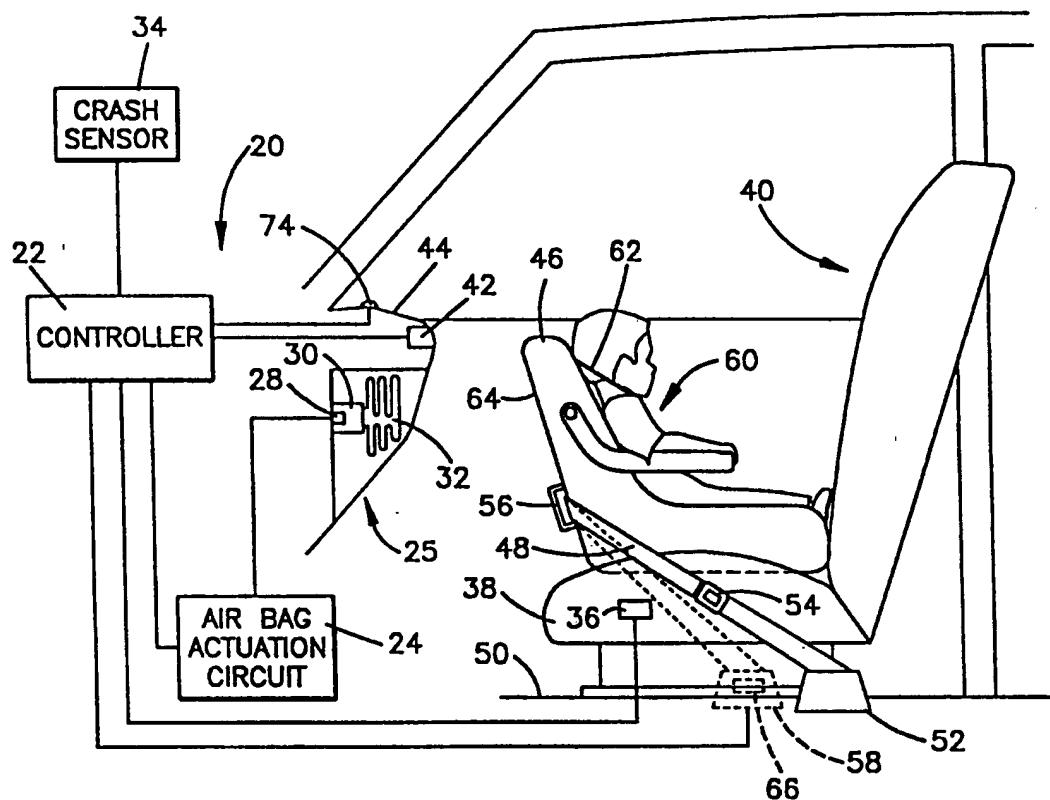


Fig.1

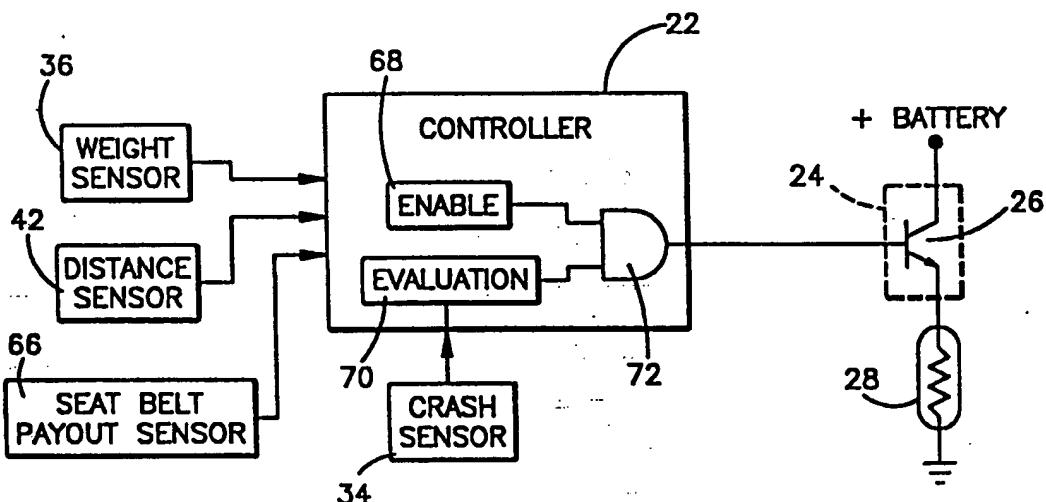


Fig.2

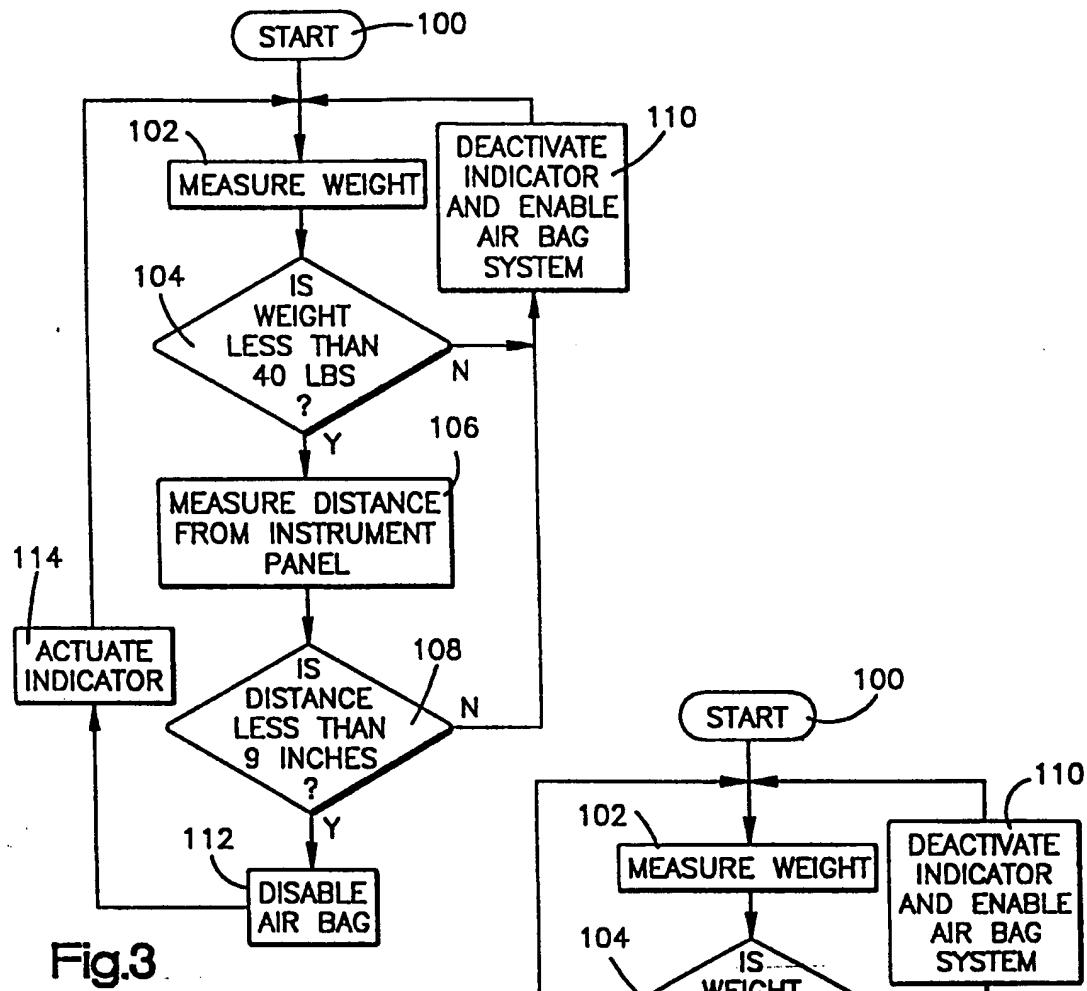


Fig.3

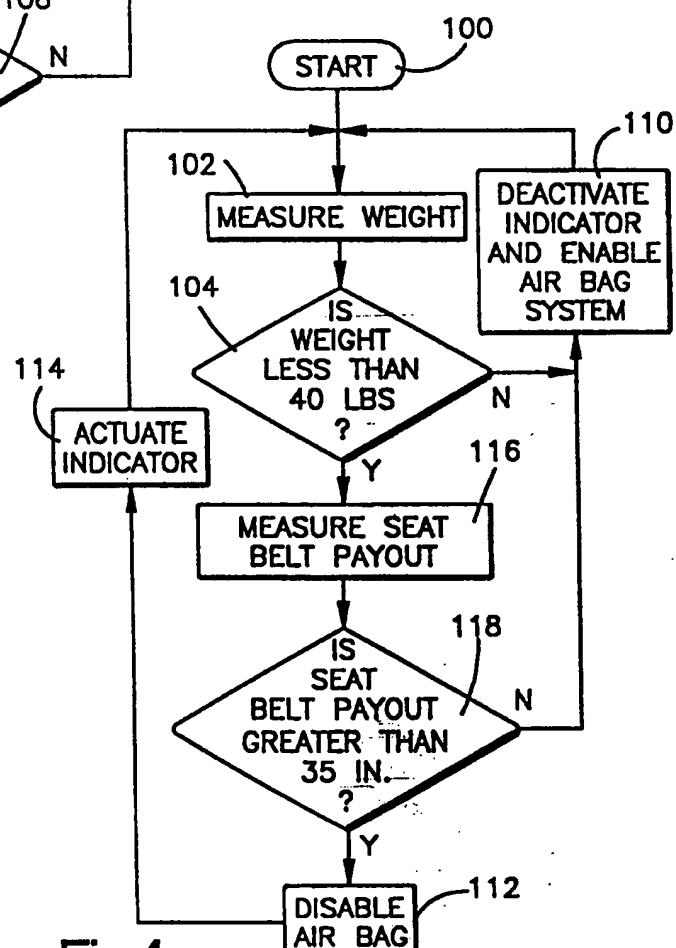


Fig.4

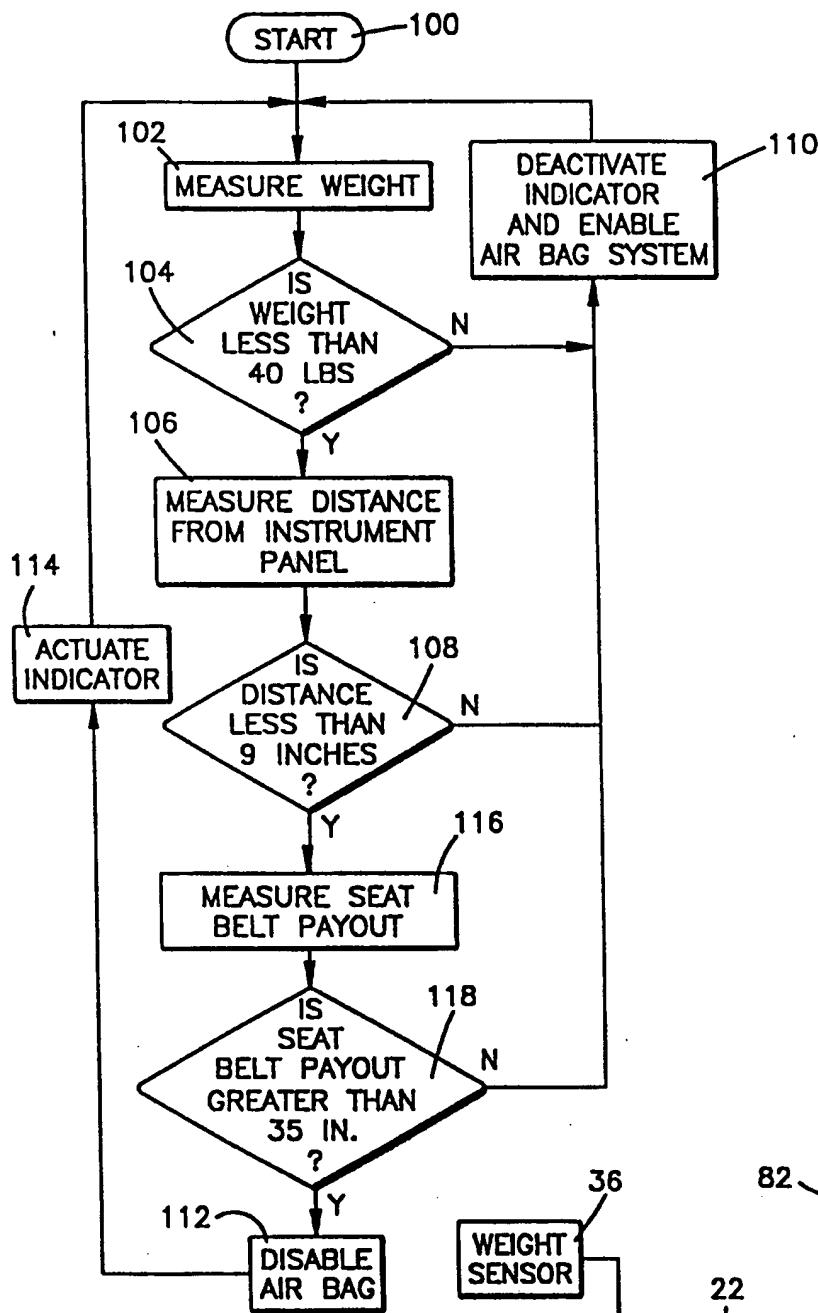


Fig.5

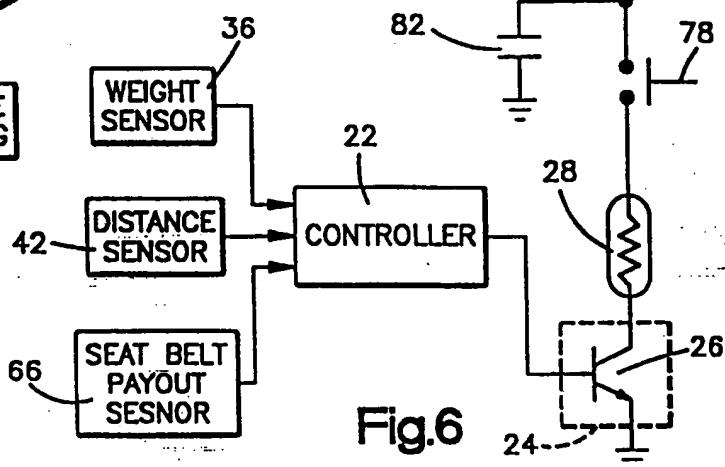


Fig.6



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 8771

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	RESEARCH DISCLOSURE, no.358, February 1994, EMSWORTH, GB page 64, XP439788 ANONYMOUS 'Passenger Side Air Bag Deployment Inhibit'	1, 6, 12, 13	B60R21/00
A	---	2-5, 7, 8, 10, 11, 14, 15, 17-19	
A	RESEARCH DISCLOSURE, no.357, January 1994, EMSWORTH, GB page 20, XP425349 ANONYMOUS 'Method for Sensing Occupant Mass and Position'	1, 10, 12, 13	
A	RESEARCH DISCLOSURE, no.357, January 1994, EMSWORTH, GB page 50, XP425363 ANONYMOUS 'Hardware System and Logic for a Tunable SIR System'	1, 10, 12, 13	
A	AUTOMOTIVE ENGINEERING, vol.102, no.5, May 1994, WARRENDALE, PA, US page 47, XP444849 'Child-seat and occupant-presence detection'	1, 10, 12, 13	B60R
P, A	AUTOMOTIVE ENGINEERING, vol.103, no.5, May 1995, WARRENDALE, PA, US pages 64 - 65, XP505532 KEVIN JOST 'Occupant detection improves'	1, 10, 12, 13	
	---	-/--	
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	24 October 1995	D'sylva, C	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone	T : theory or principle underlying the invention		
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date		
A : technological background	D : document cited in the application		
O : non-written disclosure	L : document cited for other reasons		
P : intermediate document	Q : member of the same patent family, corresponding document		



EUROPEAN SEARCH REPORT

Application Number
EP 95 10 8771

DOCUMENTS CONSIDERED TO BE RELEVANT															
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)												
D,P, A	EP-A-0 650 869 (TRW VEHICLE SAFETY SYSTEMS INC.) * figures 1,5 * * abstract * * column 3, line 21 - column 4, line 55 * * column 9, line 15 - line 44 * ---	1,10,12, 13													
A	EP-A-0 458 102 (AUDI AG) * figure * * abstract * * column 4, line 51 - column 5, line 40 * ---	1,10,12, 13													
A	GB-A-2 236 419 (GENERAL ENGINEERING B.V.) * figures * * abstract * * page 6, line 7 - page 10, line 37 * -----	1,10,12, 13													
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)												
<p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 34%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>24 October 1995</td> <td>D'sylva, C</td> </tr> <tr> <td colspan="3"> CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document </td> </tr> <tr> <td colspan="3"> T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document </td> </tr> </table>				Place of search	Date of completion of the search	Examiner	THE HAGUE	24 October 1995	D'sylva, C	CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		
Place of search	Date of completion of the search	Examiner													
THE HAGUE	24 October 1995	D'sylva, C													
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document															
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document															